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Milk-Distribution Costs in West Virginia

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by W. W. ARMENTROUT and R. O. STELZER

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Milk-Distribution Costs in West Virginia

II. A Study of the Costs Incurred by 75 Producer-Distributors in the Clarksburg, Fairmont, Morgantown, and Wheeling Markets for a Twelve-Month Period During 1934-1935*

by W. W. ARMENTROUT and R. O. STELZER

FLUID MILK AND CREAM are distributed in West Virginia by two important groups of retailers. Approximately one-half of the milk and cream is sold by milk plants which purchase practically all their supply from producers in their local market area. The remainder of the fluid milk and cream consumed is sold by producer-distributors. Any adequate study of the cost of milk distribution must therefore include these two groups of distributors.

Purpose of the Study

The costs incurred by milk plants for 1933 were studied and the results published in West Virginia Experiment Station Bulletin No. 266. The study of which this is a report was made for the purpose of ascertaining the costs incurred in distributing milk by the producer-distributors and of comparing the costs and efficiency of the two groups.

Data on costs of distributing milk by the two groups of distributors taken with data on cost of producing milk† in the same areas may be helpful in arriving at price understandings between the producer and the plant and the consumer. Individual producer-distributors may find the data helpful in measuring their own costs and efficiency with the average and in deciding whether it is to their best interest to distribute their own production or sell it to the plants.

Methods Used in the Study

Since the majority of producer-distributors had not kept records adequate for a detailed analysis of their costs, "cost routes" were established in four markets in the state. A complete list of the names and addresses of all the producer-distributors, together with their number of cows, was obtained for each of the four markets. From this list all producer-distributors having fewer than six cows were eliminated and from the remaining names a number of retailers were selected at random to become cooperators in the study. Each cooperator was furnished with a record book in which he recorded his

*Unless otherwise stated, cost of distribution by producer-distributors means cost per 100 pounds of milk-equivalent sold.

†West Virginia Agricultural Experiment Station Bulletin No. 268.

day-to-day expenses with the assistance of a representative of the department of farm economics who visited him once each month.

All data necessary to obtain a complete record of the costs of distributing milk were obtained. The following are some of the more important items:

(a) A classification of the investments showing cost, depreciation, and beginning and ending inventory of buildings, equipment, supplies, accounts receivable, and accounts payable.

(b) Quantity of milk produced and purchased.

(c) Quantity of milk, cream, and other dairy products sold each month by size of containers, test, etc.

(d) Labor: Amount and value of operator, family, and "other labor" used in each type of operation.

(e) Receipts, showing prices received for each class of fluid sales and the amount collected each month.

(f) Cash expenses.

(g) Data concerning length of milk routes, customers per day, bottles purchased, etc.

All records were for the twelve months period April 1, 1934, to March 31, 1935, except in the Wheeling market, where the period was from June 1, 1934 to May 31, 1935.

Cost data were recorded only on those parts of the farm operations directly connected with milk distribution. The problem of determining when production stops and distribution begins was solved by putting the producer-distributors on the same basis as the milk plant. In the study of milk plant cost of distribution, all costs incurred on the milk after it entered the plant were counted as distribution costs. In the case of the producer-distributor all costs incurred after the milk had entered and been cooled in the milk house were considered as distribution costs, while those costs incurred in bringing milk to this point were classed as production costs.*

Definition of Terms

A number of terms that have not been standardized are used in this report. For the purpose of indicating clearly the meaning of these terms as here used the following definitions are given:†

1. Producer-distributor, a producer of milk who sells his milk, cream and other products direct to the consumer or retailer. A milk route is maintained by him and in some cases he may buy milk to supplement his own production. Some producer-distributors may pasteurize their milk, but generally raw milk is sold.

2. Fluid sales is a term used to include the sales of milk in the form of (a) milk; (b) cream; and (c) other products such as chocolate milk, buttermilk, skimmilk, butter, and cheese.

*Milk-Production Costs in West Virginia. W. Va. Agricultural Experiment Station Bulletin No. 268.

†These terms are used in essentially the same manner as in W. Va. Agricultural Experiment Station Bulletin No. 266.

3. Unit: each container is considered as one unit. That is, each sale of one quart, one pint, one half-pint, or one pound container is considered a unit.

4. Wholesale: fluid sales to stores, restaurants, and consumers of large quantities at wholesale prices.

5. Retail: fluid sales at retail prices.

6. Cost of distribution: cost of selling milk from the time it passes over the cooler until it is delivered and paid for by the purchaser.

7. Interest costs are included as a cost calculated on the average net investment during the year at 5 percent.

8. Milk-equivalent sold is the total fluid sales converted to pounds of milk on the basis of the average test of the fluid milk sold. The milk equivalent was calculated for each individual producer-distributor on the basis of the average butterfat test of the fluid milk which he sold.

9. Volume, size: total pounds of milk-equivalent sold.

10. Returns: the total value of the product sold based on the sale price of each unit sold.

11. Investment: the total average value of buildings, equipment, supplies, and accounts receivable for the year.

12. Trips per bottle refers to the total number of units sold in bottles divided by the total number of bottles lost during the year.

13. (a) Operator: owner or renter of the retail business.
    (b) Family labor: the labor of any member of the family including wife, brother of operator, sons, daughters, etc. even though they may be paid a regular wage.
    (c) "Other labor": all labor except family and operator labor.

Method of Handling Items of Cost

The evaluation of a number of cost items is indefinite because they do not represent cash expenses. Inasmuch as the method of evaluation has not been standardized the following information indicates how such items were handled in this report.

All cost data unless otherwise specified were based on the fluid sales of milk converted to pounds of milk-equivalent since it represents the most accurate figure of volume. In only a few cases was the milk which was produced weighed and even in those cases no method was available for determining the quantity of milk lost or used by the family.

Because of the fact that the cost data were based on fluid sales no allowance was made for milk lost in the process of distributing. Changing the data to costs based on the quantity of milk passing over the cooler and adding to this figure the cost of milk lost should result in approximately the same total cost per cwt.

Interest costs were charged at the rate of 5 percent of the average investment, which was obtained by adding the beginning and closing inventory values and dividing by 2.

Depreciation represents the difference between beginning inventory value plus purchases of equipment and improvements and the closing inventory value plus any sales of equipment.

Each producer-distributor had a number of accounts that were uncollectable. The total amount of such bad accounts incurred during the record year was estimated by each cooperator and charged as a cost of distributing milk.

When labor was hired and paid for, labor costs were determined by using actual amounts paid plus an estimate of the value of any additional allowances such as house rent, garden, etc. Only that portion of the labor devoted to milk distribution was included. The operators estimated the value of the unpaid labor. In some cases where the operator valued his labor at a very high rate it was adjusted downward to bring it in line with the other records. Although this method of evaluating labor results in a slightly higher rate per hour for the operator than for hired labor, no additional allowance was made for management. Many operators spent considerable time in management which was not included as a labor cost. This was true especially on those farms where all the work of distributing was done by hired labor.

All other items were cash expenses charged at actual cost.

TABLE 1—*Average volume, cost, and other related data for 75 producer-distributors in four West Virginia markets*

Item	Clarksburg	Fairmont	Morgantown	Wheeling	Ave. of 4 markets
1. Number of records	17	24	14	20	75
2. Pounds milk equivalent sold	191,439	93,696	102,595	112,924	122,627
3. Pounds milk produced and purchased	201,189	98,998	105,208	118,588	128,544
4. Number of units sold	105.551	56,678	53.929	57,859	67,557
5. Total costs	$3253.28	$1704.25	$1791.90	$2043.40	$2162.16
6. Total average investment	$2407.33	$1325.28	$1655.19	$2006.58	$1830.80
7. Total hours labor	6542	3730	3404	4163	4421

AVERAGE VOLUME OF PRODUCER-DISTRIBUTORS' BUSINESS

Table 1 shows the average volume of the producer-distributors' business and other related factors for each of the four markets and the average of all four markets. Of the 75 producer-distributors included in this study, 17 sold milk in the Clarksburg market, 24 in the Fairmont market, 14 in the Morgantown market, and 20 in the Wheel-

ing market. Of the 24 included in the Fairmont market, one retailed milk in the city of Farmington, 4 in the city of Mannington, and one in Fairview. These 6 records are included with the 18 Fairmont records because the price of milk was approximately the same as in Fairmont and some milk producers living in this same territory sold milk in the city of Fairmont. These towns are a part of the greater Fairmont market.

A total of 9,197,005 pounds of milk-equivalent was sold by the 75 producer-distributors in the four markets. This is an average of 122,627 pounds per year for each retailer. The producer-distributors in the Clarksburg market had the largest volume, which averaged 191,439 pounds of milk-equivalent sold. The average of the Fairmont group was 93,696 pounds, of the Morgantown group 102,595, and of the Wheeling group 112,924 pounds.

The range in volume for individual producer-distributors was from 29,257 pounds to 421,692 pounds. This wide range indicates that some of the largest as well as some of the smallest producer-distributors were included in the study. The average yearly sales of 122,062 pounds is equivalent to approximately 39 gallons daily. The smallest retailer sold, therefore, only 9.3 gallons daily, while the largest sold 134 gallons.

The producer-distributors produced and purchased an average of 5,917 pounds more milk than they sold. This is equivalent to 4.6 percent of the milk sold. The range was from 2.5 percent in the Morgantown market to 5.4 percent in the Fairmont market. Not all the difference between the quantity produced and purchased and the quantity sold was lost in distribution, but a part of it was used by the family for household purposes. Accurate data were not available to indicate the exact amount used by the family, since a large portion of the milk returned from the routes was converted to family use each day. Such data as were available indicate that about one-half of the 5,917 pounds was used by the family and the remainder lost in handling and distributing milk.

Number of Units Sold

The average number of units sold was 67,557 per producer-distributor, ranging from 13,232 units to 207,249. In each of the markets the average number of pounds of milk-equivalent sold per unit was slightly less than 2 pounds.

Total Distribution Cost Per Distributor

The total costs of distributing milk averaged $2,162.16 for all the producer-distributors. The average cost was highest in the Clarksburg market ($3,253.28) and lowest in the Fairmont market ($1,704.25). The total cost for individual distributors was influenced to a large extent by the volume of business, although the retailer selling the smallest number of pounds of milk-equivalent did not have the lowest costs. The range in cost was from $438.94 to $7,701.12.

Amount of Investment

The average producer-distributor had $1,830.80 invested in buildings and equipment used exclusively for distributing milk and in accounts receivable. The range in investment for individual producer-distributors was from $329.90 to $5,462.50.

Hours of Labor Used in Milk Distribution

The total hours of labor devoted to preparing and delivering milk averaged 4,421 hours per distributor. This is equivalent to the entire time of one man working about 12 hours each day of the year or two men working six hours each day. In nearly all cases the work was done by more than one person. A part of their time was spent in distributing milk and the remainder was usually devoted to other types of farm work. This was true especially on those farms where most of the work was done by the operator and his family. The total number of hours of labor devoted to distribution varied from 1,152 to 11,901 hours per individual distributor.

TABLE 2—*Average cost of distributing 100 pounds of milk equivalent by 75 producer-distributors in four West Virginia markets*

Item	Clarksburg	Fairmont	Morgantown	Wheeling	Average
1. Labor: operator	$0.447	$0.393	$0.433	$0.498	$0.444
family	.079	.217	.152	.240	.163
other	.374	.278	.331	.113	.280
2. Repairs	.015	.014	.009	.010	.012
3. Depreciation	.131	.167	.192	.174	.160
4. Bottles and bottle exchange	.076	.040	.041	.049	.056
5. Caps	.027	.029	.031	.022	.027
6. Other supplies	.129	.116	.082	.111	.114
7. Taxes	.003	.004	.005	.006	.004
8. Insurance	.001	.001	.002	.003	.002
9. Truck operating cost*	.228	.346	.295	.374	.303
10. Bad debts	.090	.121	.076	.075	.091
11. Interest	.063	.071	.081	.089	.074
12. Other	.036	.023	.017	.046	.033
Total	1.699	1.820	1.747	1.810	1.763

*Does not include depreciation, interest, or taxes on trucks. See discussion on page 12.

ANALYSIS OF DISTRIBUTION COSTS

The cost of distributing 100 pounds of milk-equivalent and the classification of these total costs into the more important items are shown in Tables 2 and 3. Table 2 gives the actual costs per 100 pounds of milk-equivalent sold for each market and the average of the four markets, whereas Table 3 shows the importance of each item on the basis of percentage of total cost.

Total Cost of Distributing Milk: $1.763 per Cwt. of Milk-Equivalent Sold

The average cost of distributing milk for the 75 producer-distributors was $1.763 per cwt. of milk-equivalent sold. The average costs for each of the four markets were not greatly different, being lowest in the Clarksburg market ($1.699) and highest in the Fairmont market ($1.820). The marked uniformity in the average total cost for each market does not apply to individual distributors. The range in costs for individual distributors was from $1.058 to $3.387. Four

TABLE 3—*Classification of cost items on percentage basis for 75 producer-distributors in four West Virginia markets*

Item	Clarksburg	Fairmont	Morgantown	Wheeling	Ave. of 4 markets
Labor: total	53.0	48.8	52.3	47.0	50.3
operator	26.3	21.6	24.7	27.5	25.2
family	4.7	11.9	8.6	13.3	9.2
other	22.0	15.3	19.0	6.2	15.9
Repairs	.8	.7	.5	.5	.7
Depreciation	7.8	9.3	11.0	9.7	9.1
Bottles and bottle exchange	4.4	2.2	2.4	2.7	3.1
Caps	1.6	1.6	1.7	1.2	1.5
Supplies	7.6	6.4	4.7	6.1	6.5
Taxes	.2	.2	.3	.3	.2
Insurance	.1	.1	.1	.2	.1
Truck operating cost*	13.4	19.0	16.9	20.7	17.2
Bad debts	5.3	6.6	4.4	4.1	5.2
Interest	3.7	3.9	4.6	4.9	4.2
Other	2.1	1.2	1.1	2.6	1.9
Total	100.0	100.0	100.0	100.0	100.0

*Does not include depreciation, interest or taxes on truck. See discussion on page 12.

distributors had a cost of more than $3.00 per cwt. and 10 had a cost of more than $2.50, while five had a cost of less than $1.25 and 18 had a cost of less than $1.50. The average distributor sold 122,627 pounds of milk-equivalent at a total cost of $2,162.16. If to this cost the cost of milk lost were added, the resulting figure would be approximately the same as that obtained by calculating costs on the basis of pounds of milk produced and bought for distribution. For example, if one-half of the difference between the quantity of milk produced and bought for distribution and the quantity sold were lost in distribution and charged as a cost at the rate of $2.10 per cwt., the average distribution cost would be $1.777 per cwt. of milk produced and purchased less that amount consumed by the family.

Labor Cost: 88.7c per Cwt. of Milk-Equivalent Sold

Labor cost was the most important item of cost for each of the producer-distributors, amounting on the average to 50.3% of all costs or 88.7c. The cost of labor averaged 90c for the Clarksburg group,

88.8c for the Fairmont group, 91.6c for the Morgantown group, and 85.1c for the Wheeling group of distributors. The range in labor costs for individual retailers was from 39c to $2.747. Only five of the 75 distributors had a labor cost of more than $2.00, while six had a cost of less than 50c.

The labor used to distribute milk was classified into three types: operator, family, and other. Operator's labor was the most important of the three types, amounting to approximately one-half of the total labor cost and equal to one-fourth of the total distributing cost. The cost of operator's labor averaged 44.4c for all the distributors, 44.7c for the Clarksburg group, 39.3c for the Fairmont group, 43.3c for the Morgantown group, and 49.8c for the Wheeling group.

The cost of family labor represented 9.2% of the total cost of distributing, ranging from 4.7% for the Clarksburg group of distributors to 13.3% for the Wheeling group. It averaged 16.3c and in many cases represented actual cash paid. The Clarksburg group had the lowest family labor costs, equivalent to 7.9c, while the Wheeling group had the highest family labor cost of 24c.

Other labor costs represented 15.9% of the total distribution costs, the range being from 6.2% for the Wheeling group to 22% for the Clarksburg group. This item averaged 28c, the range for market groups being from 11.3c to 37.4c.

Repairs and Depreciation Cost: 17.2c per Cwt. of Milk-Equivalent Sold

The cost of repairs to buildings and equipment, exclusive of truck repairs, averaged 1.2c per cwt. of milk-equivalent sold. Several of the producer-distributors had no repair costs but had a higher than average depreciation cost. Depreciation on all buildings, equipment (including truck depreciation), and supplies averaged 16c. The total cost of repairs and depreciation amounted to 9.8% of total distribution cost. The cost of depreciation and repairs was fairly uniform among retailers, being lowest in the Clarksburg market (14.6c) and highest in the Morgantown market (20.1c).

Those producer-distributors having a relatively large investment for the quantity of milk sold had the highest depreciation costs per cwt. whereas those with a low depreciation cost had a relatively small investment, usually in trucks, buildings, and equipment that was several years old and of low value. Many of the producer-distributors with small investment used hand methods rather than machinery to do the various types of work connected with distributing milk.

Truck depreciation was the largest single depreciation item, amounting to 9.8c. This was 61% of the total depreciation cost. The remaining depreciation costs were divided into such smaller items as building and equipment, including bottles, caps, cooler, washer, boiler, and other supplies.

Cost of Bottles, Caps, and Supplies: 19.7c per Cwt. of Milk-Equivalent Sold

The average cost of bottles was 5.6c per cwt. of milk sold, the range in costs being from 4c in the Fairmont market to 7.6c in the Clarksburg market. The Fairmont market did not have a bottle exchange, while the other three markets did have an exchange or association in operation for a part or all of the year. Not all the distributors, however, belonged to the exchange in any one of the three markets.

Data from the various markets indicate that the bottle exchanges as operated did not reduce the cost of bottles. The bottle cost for the Morgantown and the Wheeling markets, where a bottle association was in operation, was practically the same as in the Fairmont market. The costs of the small-volume distributors in the Fairmont market who sold milk in the small towns of Mannington, Fairview, and Farmington tended, however, to reduce the average bottle cost in the Fairmont market. Such other factors as efficiency of the exchange, cost of bottles before an exchange was established in the market, type of exchange in operation, and number of distributors belonging to it, should be considered carefully before concluding that a bottle exchange was impracticable.

It will be noted that the cost of bottles was considerably higher in Clarksburg than in the other three markets. This may be accounted for to some extent by the type of bottle association in operation during a part of the year. The association was operated on the basis that each member pays into the association each month one cent for each gallon of milk sold and allows each member to draw out as many bottles as necessary. This method of payment did not offer any inducement to the distributor to collect bottles and resulted in a large number being drawn from the association by each member. The payments into the association did not meet the cost of the bottles. The association was reorganized during the year and the members are continuing to pay for the bottles in order to liquidate the association. This eventually will result in each member paying for all the bottles he obtained from the association. The bottle cost shown for the Clarksburg market was based, therefore, on the actual value of the bottles drawn rather than on the one-cent-per-gallon payment.

The cost of caps was fairly uniform for each market, averaging 2.7c per cwt. of milk and ranging from 2.2c to 3.1c for the various markets. The difference in cap cost is due primarily to the difference in size of units sold in the various markets.

The cost of such supplies as ice, disinfecting material, cleaning compounds, and brushes was 11.4c per cwt. of milk. Variations for individual distributors were due to such factors as the quantity of soap and disinfectant used, the price paid for these, and especially the kind of equipment used. For example, a retailer using an electric

refrigerator would have little or no ice costs. The cost of electricity was included under the caption "other costs".

The total cost of bottles, caps, and supplies averaged 19.7c and was equivalent to 11.1% of the total costs. The sum of these three items was highest in the Clarksburg market, where they averaged 13.6% of all costs, and lowest in the Morgantown market, where they averaged 8.8% of all costs.

Cost of Taxes and Insurance: 0.4c per Cwt. of Milk-Equivalent Sold

Taxes varied with the assessed value and with the total investment in buildings and equipment whereas the cost of insurance varied with the rate of insurance as well as the value of the insured buildings and equipment.

The lowest cost of taxes for any one distributor was .1c per cwt. and the highest was 1.1c, with an average of .4c.

Only 32 of the 75 producer-distributors carried insurance on their buildings and equipment exclusive of trucks. This cost for the 32 retailers ranged from .1 to .8c per cwt. and averaged .2c when spread over all 75 producer-distributors. The sum of these two items represents only .3% of the total distributing cost.

Cost of Operating Trucks: 30.3c per Cwt. of Milk-Equivalent Sold

The cost of operating trucks was the second largest cost item, averaging 30.3c per cwt., or 17.2% of all costs. The average cost of trucks as shown in Tables 2 and 3 does not include truck depreciation, interest, or taxes. The items making up the 30.3c of truck costs include only gasoline, oil, repairs, insurance on trucks, licenses, and tires.

Truck depreciation amounted to 9.8c, while interest and taxes on trucks were equal to approximately one cent. When these costs were added to the average truck costs of 30.3c, the total of all truck costs was 41.1c which was 23.3% of the total cost. The variation for individual producer-distributors was from 24 to 75c; a large part of this was due to the value of the truck, miles traveled each day, pounds of milk sold per trip, and to the size of the repair bill. For example, one producer-distributor had an unusually high truck cost because of a wreck which was not covered by insurance.

One producer-distributor sold all his milk through one store, which would tend to reduce truck and other delivery costs, while another used a horse to deliver milk for a part of the year. The cost of maintaining the horse was included under truck cost. It is interesting to note that this producer-distributor had exactly the same truck cost per cwt. as his horse-and-wagon costs.

Interest Cost: 7.4c per Cwt. of Milk-Equivalent Sold

The average cost of interest on investment was 7.4c and varied from 6.3c for the Clarksburg group of producer-distributors to 8.9c for the Wheeling group. The interest cost varied directly with the

total investment per cwt. of milk sold and the efficiency in use of equipment. The business of the average-sized producer-distributor in the Clarksburg market was much larger than in the other three markets, which accounted for the smaller interest cost. The average investment per cwt. of milk was only $1.26 for the Clarksburg group of retailers as compared with $1.42 for the Fairmont group, $1.61 for the Morgantown group, and $1.78 for the Wheeling group.

Data in Table 1 show that the Clarksburg group of retailers had the largest investment per producer-distributor but because of the size of business were able to make more efficient use of their equipment. The producer-distributor having a relatively low investment will have a low interest cost. This, however, does not represent the ideal situation, since the building and equipment may not be adequate to distribute milk efficiently. For example, a number of producer-distributors did not have any equipment for heating water in the milk house, but depended upon water heated in the house. The use of equipment such as bottle washers, bottles, boilers, and good trucks would increase the investment and with it, the interest costs, yet would lower labor cost and make it possible to sell a higher-quality milk.

Interest cost represented 4.2 percent of the total distributing costs, varying from 4.9% in the Wheeling market to 3.7% in the Clarksburg market.

Cost of Bad Debts: 9.1c per Cwt. of Milk-Equivalent Sold

Every producer-distributor sold some milk on the credit basis, which resulted in some loss because of bad debts. The average cost for this item was 9.1c and varied for individual distributors from a low of 1.7c to a high of 27.5c.

Bad debts represent 5.2% of the total cost of distributing milk for the 75 distributors, being highest in the Fairmont market, where the average was 6.6%, and lowest in the Wheeling market, where it was 4.1%.

The losses due to accounts not collected represent approximately 2.5% of the total value of the milk sold: i.e., out of every $100 of milk sold during the twelve-months period for which records were taken, $2.50 was not collectible. A larger amount than this remained uncollected at the close of the year, but this figure represents the operator's estimate of the amount he does not expect to collect.

Other Costs: 3.3c per Cwt. of Milk-Equivalent Sold

Other costs incurred in distributing milk consisted of the following items: coal, oil, gas, electricity, advertising, milk permits and licenses, and inspection costs. All these were cash items, but some producer-distributors did not incur expenses for all of them. For example, some producer-distributors used coal, others gas or electricity in heating water and in operating the equipment in the milk house. The total of these costs averaged 3.3c per cwt. for the 75

producer-distributors and was equivalent to 1.9% of the total cost of distributing milk. The range for individual producer-distributors was from 3c to 12.8c. In those cases where the cost was low no electricity or gas was used and no advertising was done. In fact, beyond the advertising carried on their trucks, only one producer-distributor did any additional advertising.

Total Distribution Cost per Quart: 3.79c

The data on costs were shown on the basis of 100 pounds of milk-equivalent sold because the various types of fluid sales were expressed in terms of total pounds of milk-equivalent sold. This method of determining a common unit for all the fluid sales of the producer-distributors can be changed to the quart-of-milk-equivalent basis by dividing the cost per cwt. by the number of quarts in 100 pounds of milk. The approximate number of quarts in 100 pounds of milk is 46.5, varying from this figure slightly because of the butterfat and solid content of the milk and the temperature at which it is bottled. The cost per gallon can be determined by dividing the cost per cwt. by 11.63 or by multiplying the cost per quart by 4.

TABLE 4—*Classification of costs on the quart basis: Average costs for 75 producer-distributors in the Clarksburg, Fairmont, Morgantown, and Wheeling markets*

Item	Cents per quart
1. Labor: operator	0.955
family	.350
other	.602
2. Repairs	.026
3. Depreciation	.344
4. Bottles	.120
5. Caps	.058
6. Supplies	.245
7. Taxes	.008
8. Insurance	.004
9. Truck operating cost*	.652
10. Bad debts	.196
11. Interest	.159
12. Other	.071
Total cost of distribution per quart	3.790

*Does not include truck depreciation, interest, or taxes.

Based on the conversion factor 46.5, the average costs per quart are shown in Table 4. The classification is exactly as shown in Table 2. The total average cost per quart was 3.79c for the 75 producer-distributors. The average cost for each of the four markets was as follows: Clarksburg group, 3.65c; Fairmont group, 3.91c; Morgantown group, 3.75c; and Wheeling group, 3.89c.

The average cost of labor was equivalent to 1.907c per quart. The operator labor accounted for .955c, the family labor for .350c, and the "other labor" for .602c per quart.

Truck operating costs were equivalent to .652c per quart; depreciation and repairs, .370c; supplies, .245c; bottles and caps, .178c; bad debts, .196c; interest, .159c; and all other costs, .083c.

CLASSIFICATION OF COSTS INTO PLANT, DELIVERY, ADMINISTRATIVE, AND INTEREST COSTS

Costs may be classified into: (a) plant costs incurred in the preparation of milk for delivery, (b) delivery costs incurred in delivering and selling milk, (c) administrative costs, and (d) interest costs. The costs for each of these four classifications are shown in Table 5.

TABLE 5—*Classification of plant, delivery, administrative, and interest costs for 75 producer-distributors in four West Virginia markets*

Item	Costs per 100 pounds milk	Percent of total costs
1. Plant Costs: Total	$0.391	22.1
(a) Labor	.195	11.0
(b) Depreciation	.062	3.5
(c) Supplies and repairs	.102	5.8
(d) Insurance and other	.032	1.8
2. Delivery Costs: Total	1.200	68.1
(a) Labor	.692	39.3
(b) Bottles, caps and other supplies	.107	6.0
(c) Truck, including truck depreciation*	.401	22.8
3. Administration: Total	.198	5.6
(a) Bad debts	.091	5.2
(b) Taxes	.004	.2
(c) Advertising and licenses	.003	.2
4. Interest: Total	.174	4.2
Total	$1.763	100.0

*Does not include interest and taxes on trucks, which amounted to 1 cent.

Approximately two-thirds of the total cost was for delivery, which amounted to $1.20 per cwt. of milk-equivalent sold. This item included 69c for labor; 11c for bottles, caps, and other supplies; and 40c for all truck costs.

Plant cost was 22% of the total costs and amounted to 39.1c per cwt. It included 19.5c for labor, 6.2c for depreciation, 10.2c for supplies and repairs, and 3.2c for insurance and miscellaneous items.

Administrative cost was 5.6% of the total cost and amounted to 9.8c per cwt. It consisted of 9.1c for bad debts; .4c for taxes; and .3c for advertising, milk licenses, etc.

Interest cost was 4.2% of the total cost and amounted to 7.4c per cwt. of milk-equivalent sold.

CLASSIFICATION OF FLUID SALES

The fluid sales of the 75 producer-distributors were made in the form of milk, cream, and other products at retail and wholesale prices. The percentage of fluid sales at retail and wholesale prices is shown in Table 6, which shows also the percentage of fluid sales in the form

of milk, cream, and other products as well as the average number of units of each product sold by the distributors in each market and the average of the 4 markets.

The data indicate that 72.8% of the fluid sales was at retail prices. The percentage for each market was 67.2 for Clarksburg, 68.2 for Fairmont, 68.7 for Morgantown, and 90.1 for the Wheeling market. Nine of the 75 producer-distributors sold all their products at retail prices. Practically all the wholesale milk was sold to stores and restaurants. In a few cases, however, consumers buying large quantities at wholesale prices were classified as wholesale stops.

TABLE 6—*Classification of fluid sales: Average for 75 producer-distributors for four West Virginia markets*

Item	Clarksburg	Fairmont	Morgantown	Wheeling	Ave. of 4 markets
1. Percent of all fluid sales:					
(a) Retail	67.2	68.2	68.7	90.1	72.8
(b) Wholesale	32.8	31.8	31.3	9.9	27.2
2. Percent of milk-equivalent sold as:					
(a) Fluid milk	81	92	90	84	86
(b) Cream	13	5	6	12	10
(c) Other products..	6	3	4	4	4
3. Units of milk sold in:					
(a) Gallons	653	79	710	166	350
(b) Quarts	51078	27606	30168	37734	36105
(c) Pints	31335	22846	16775	11207	20533
(d) ½-Pints	12166	3754	2301	2323	5008
4. Units of cream sold in:					
(a) Gallons	41	1	0	0	9
(b) Quarts	983	0	0	128	257
(c) Pints	213	167	999	603	449
(d) ½-Pints	6602	1753	995	4108	3340
5. Units sold as:					
(a) Buttermilk	765	311	595	738	581
(b) Skimmilk	619	20	107	554	314
(c) Chocolate milk..	165	0	1047	233	295
(d) Butter	168	58	50	60	82
(e) Cottage cheese..	585	77	161	5	188
(f) Other*	178	6	21	0	46
Total units per year	105551	56678	53929	57859	67557

*Includes ice cream and surplus cream shipped.

A very large proportion of the fluid sales was in the form of fluid milk. The Fairmont producer-distributors sold 92% of the total milk equivalent in the form of milk, the Clarksburg group sold 81%, while the average for the 4 markets was 86%.

Cream sales amounted to 10% of the total milk-equivalent sold and varied from 5% for the Fairmont group to 13% of the total fluid sales for the Clarksburg group.

The remaining 4% of milk-equivalent was sold as other products such as buttermilk, skimmilk, chocolate milk, cottage cheese, butter, etc.

A study of the records of individual producer-distributors shows that 19 of the 75 producer-distributors sold all their products in the

form of fluid milk, while 28 sold only fluid milk and cream. In addition to milk and cream, cottage cheese was sold by 13 producer-distributors, buttermilk by 22, and butter by 17. Practically all the producer-distributors attempted to sell their milk as fluid milk and cream. Any surplus was converted to one or two other products and sold to their fluid milk and cream customers. Only a few retailers had a regular outlet for other products or made a special effort to sell a large amount of their milk in this form.

The milk-equivalent sold as fluid milk was delivered in gallon, quart, pint, and one-half pint containers. The largest amount was sold in quart bottles, the average retailer selling 36,105 quarts, 20,533 pints, 5,008 one-half pints, and 350 gallons of fluid milk. Only 11 producer-distributors sold milk in gallon containers. All sold milk in quart and pint bottles and approximately one-half of them sold some fluid milk in ½-pint bottles.

Cream sales were limited almost entirely to one-half pints. The average distributor sold 3,340 one-half pints, 449 pints, 257 quarts, and 9 gallons of cream. Only two distributors sold cream in gallons and only 12 sold it in quarts.

The other products were sold in various-sized units: chocolate milk usually in pints, cheese in 10 to 16-ounce packages, skimmilk in gallons, butter-milk in quarts and gallons, and butter in one-pound cartons. The average total units of other products sold was 1,506.

The total number of units sold by the average producer-distributor was 67,557. The Clarksburg producer-distributors sold an average of 105,551 units; the Fairmont distributors, 56,678; the Morgantown distributors, 53,929; and the Wheeling distributors, 57,859.

FACTORS AFFECTING COSTS OF DISTRIBUTION

The cost of distributing milk varied among the several producer-distributors because of the difference in such factors as volume, truck miles per day, investment, labor cost, and other items. The effects of some of these more important items on total cost are shown in Tables 7 to 12 inclusive. Analysis of these factors showing their effect on total cost should indicate to the consumer and distributor why costs vary, and may assist the producer-distributors in reducing some of their costs.

Volume

One of the important factors affecting cost was the volume of business as measured by the total pounds of milk-equivalent sold during the year. A summary of the manner in which costs are affected by volume is shown in Table 7. The producer-distributors were classified into three groups: the first group of 19 each sold more than 150,000 pounds of milk during the year; the second group of 38 each sold more than 70,000 and less than 150,000 pounds of milk, and the third group of 18 each sold 70,000 pounds or less of milk-equivalent.

The first group averaged 252,064 pounds of milk at a cost of $1.602 per cwt. of milk-equivalent sold. The second group averaged 106,542 pounds of milk at a cost of $1.790, while the third group averaged only 55,531 pounds of milk at a cost of $2.33 per cwt.

The group having a medium volume sold 51,011 pounds more milk than the group having a small volume, at a saving of 54c per cwt., but the large-volume group sold 145,522 pounds more milk than the group of medium volume, at a saving of only 19c per cwt. This indicates that the high distribution cost of some producer-distributors was due to a smaller than optimum volume of business.

The high cost of the producer-distributors having a small volume was due mainly to their inefficient use of labor and trucks. The figures in the table show that the cost of labor for this group was $1.31 as compared with 79.6c for the group of distributors having the largest volume. This is a difference of 52.4c equivalent to 72% of the difference in cost between the two groups. The saving in labor cost was the result of increased efficiency in the use of labor. The large-sized group of distributors sold 36 pounds of milk for every hour of labor at a cost of 28c per hour, while the group with a small volume sold 17 pounds for every hour of labor at a cost of 22c per hour.

TABLE 7—*Relation between volume of producer-distributors and costs and other related data for 75 producer-distributors in four West Virginia markets*

Item	Large volume prod-dist.	Medium volume prod-dist.	Small volume prod-dist.
1. Number of records	19	38	18
2. Range in size	421,000-150,000	149,000-70,000	69,000-29,257
3. Average pounds milk equivalent sold	252,064	106,542	55,531
4. (a) Cost of labor	$ .796	$ .880	$1.310
(b) Interest costs	.071	.074	.082
(c) Truck operating costs*	.228	.354	.440
(d) Other costs	.507	.482	.498
(e) Total all costs	1.602	1.790	2.330
5. Investment per cwt.	1.43	1.49	1.64
6. Pounds milk per hour labor	36	25	17
7. Truck costs per mile†	$ .062	$ .045	$ .053
8. Trips per bottle	38	49	68
9. Percent milk sold retail	74	70	79
10. Truck miles per 100 pounds milk sold	5.0	10.0	11.2
11. Pounds milk sold per truck mile	20.0	10.0	9.0

*Does not include depreciation and interest or taxes.
†Includes depreciation, interest, and taxes.

Truck operating cost was 23c per cwt. of milk sold for the group with a large volume, and 44c for the group with a small volume. The difference of 21c represents approximately 29% of the difference in costs between these two groups. The variation in truck costs was due in part to the difference in the amount of milk sold per mile. The

large-volume group sold 20 pounds of milk-equivalent per mile as compared with only 9 pounds per mile for the group of distributors with a small volume.

The group with the large volume had an investment of $1.43 per cwt. of milk-equivalent sold; the group with medium volume, $1.49; and the group with small volume, $1.64. Difference in interest and depreciation cost would therefore vary only slightly for each of the groups.

TABLE 8—*Efficiency of labor: Classification of producer-distributors on basis of pounds milk sold per hour of labor*

Item	Milk sold per hour of labor		
	35 pounds and over	21-34 pounds	Less than 21 pounds
1. No. of records	18	40	17
2. Range in pounds milk per hour labor	35-52	21-34	6-20
3. Average pounds milk sold per hour labor	40.3	27.7	16.3
4. Average pounds milk sold	166,899	121,807	77,678
5. Total cost per 100 pounds milk sold	$1.448	$1.792	$2.375
6. Labor cost per 100 pounds milk sold	$ .622	$ .933	$1.323
7. Miles traveled per 100 pounds milk sold	6.2	8.1	10.1
8. Customers per mile	4.0	3.0	3.0
9. Cost of labor cents per hour	25.1	25.8	21.5
10. Average-sized unit sold (pounds)	1.7	1.8	1.8
11. Investment per 100 pounds milk	$1.78	$1.22	$1.78

Labor Efficiency

The efficient use of labor had a decided effect upon cost because it was the most important cost item and because of its wide variation among producer-distributors. One of the best methods of showing labor efficiency is by classifying the producer-distributors into groups based upon the pounds of milk sold per hour of labor. Table 8 classifies them on this basis. Eighteen of the 75 producer-distributors sold more than 34 pounds of milk per hour of labor and may be considered to have used labor very efficiently; 40, averaging 27.7 pounds of milk per hour of labor, were classed as being of average labor efficiency; and 17, averaging 16.3, were classed as making inefficient use of their labor. The first group of retailers required, therefore, approximately 2.5 hours of labor costing 25.1c per hour to sell 100 pounds of milk, while the least efficient group required 6.1 hours of labor costing 21.5c per hour to sell the same amount of milk. The cost of labor was $1.323 per cwt. for the least efficient group, which was more than twice the cost for the most efficient group.

The total cost of distributing milk averaged $1.45 for the group selling more than 34 pounds of milk per hour of labor. The group

averaging 27.7 pounds per hour of labor had a cost of $1.79, whereas the third group, selling 16.3 pounds of milk per hour of labor, had a cost of $2.375.

There were three apparent reasons for the differences in labor efficiency: first, the volume of business of the producer-distributor; second, the miles traveled in selling 100 pounds of milk; and third, the type of labor used.

The retailers making the most efficient use of their labor had a larger than average volume (166,899 pounds of milk) while those making inefficient use of their labor had smaller than average volume (77,678). The retailers with large volume evidently required a relatively smaller amount of labor in washing, cleaning and other so-called plant operations. On the other hand some of the retailers, even though they made efficient use of their labor, may not have devoted enough time to those operations which make it possible to distribute a quality product. Labor can be saved by failing to cool or handle milk properly or to keep the milk equipment clean. If this was done, then the labor saved by this method does not represent an ideal situation. The amount of investment per cwt. of milk did not vary with the efficient use of labor except for the medium-volume group, where the total investment was slightly less than for the other two groups.

The group of retailers making efficient use of their labor was able to effect a considerable saving by having relatively short routes. This group traveled 6.2 miles in selling 100 pounds of milk and had four customers per mile traveled as compared with the least efficient group which traveled 10.1 miles and had only three customers per mile. The time saved in traveling fewer miles to sell 100 pounds of milk and in having the customers more concentrated was reflected in reduced labor costs.

The third factor affecting labor costs was the type of labor used in distributing milk. The cost per hour of labor as well as its efficiency were influenced by the type of labor employed. The cost per hour of the operator labor was considerably higher than the hourly rate for either family or other labor. This being true a cost of 25.1c per hour for the labor of the most efficient group would indicate that the operator devoted more time to the distribution of milk in this group than in the case of the least efficient group, where the cost was 21.5c per hour.

The quantity, cost, and percentage of total number of hours for each type of labor are shown in Table 9. Although the operators' labor amounted to approximately 50% of the total labor cost, it represented only 37% of the total number of hours of labor. Operator's labor was valued at 33.1c per hour as compared with 19.5c for family and 19.6c for other labor. The value of operator's labor per hour was highest in the Clarksburg market, being 40.2c per hour, and lowest in the Wheeling market, where the cost was 28.7c.

The cost per hour of the operator's labor was much higher than of family and "other labor" because he was usually capable of doing more work, was better trained, and had a greater interest in the work. In many cases the workers classed as family and "other labor" consisted of boys and girls who were untrained and not capable of doing as much work as the operator. The total hours of labor for the operator as well as the cost per hour of this labor does not include cost of management. Of the 75 distributors included in the study, 13 did not have any operator's labor. In these cases as well as the others the cost of management was omitted because the operators did not spend any appreciable time in supervision or management.

TABLE 9—*Quantity, type, and value of labor used by 75 producer-distributors in four West Virginia markets*

Item	Clarksburg	Fairmont	Morgantown	Wheeling	Ave. of 4 markets
1. Operator:					
(a) Hours per retailer..	2136	1277	1218	1961	1643
(b) Value per hour (cents)	40.2	28.8	36.4	28.7	33.1
2. Family:					
(a) Hours per retailer..	936	872	778	1470	1028
(b) Value per hour (cents)	16.2	23.3	19.8	18.4	19.5
3. Other:					
(a) Hours per retailer..	3470	1581	1408	732	1750
(b) Value per hour (cents)	20.7	16.5	24.1	17.5	19.6
4. Total:					
(a) Hours per retailer..	6542	3730	3404	4163	4421
(b) Value per hour (cents)	26.3	22.3	27.5	23.1	24.6
5. Percent of total hours:					
(a) Operator	33	34	36	47	37
(b) Family	14	23	23	35	23
(c) Other	53	43	41	18	40
6. Pounds milk sold per hour of labor	29	25	30	27	28

Family labor to the amount of 1028 hours, costing 19.5c per hour, was used by the average producer-distributor. The cost of family labor ranged from 16.2c per hour in the Clarksburg market to 23.3c in the Fairmont market. This type of labor accounted for 23% of the total hours of labor used in distributing milk, being highest in the Wheeling market and lowest in the Clarksburg market.

Approximately 40% of the hours of labor used in distributing milk was other than family or operator's labor. This amounted to an average of 1750 hours per producer-distributor costing 19.6c per hour. The Wheeling group used the smallest amount of "other labor," or 732 hours per producer-distributor, while the Clarksburg group had the largest amount, or an average of 3470 hours. In the Wheeling group 18% of the total hours of labor was "other labor" as compared with 53% in the Clarksburg group.

Investment

The amount invested in buildings and equipment had no appreciable effect on the total cost of distributing milk unless the investment was more than $1.74 per cwt. of milk-equivalent sold. Table 10 shows that the total cost per cwt. was $1.70 for the producer-distributors having an investment of less than $1.00 per cwt., whereas the cost for those with an investment of more than $1.74 averaged $2.007. The difference in cost was divided among the several cost items including labor, depreciation, and interest.

The data show that the high-investment group of producer-distributors used only a little more labor to sell 100 pounds of milk than was used by the low-investment group, the amount of labor necessary to sell 100 pounds being 3.9 hours and 3.6 hours for the high-investment and the low-investment group respectively.

Interest cost calculated at a uniform rate of 5% would increase directly as the investment increases. The small investment group having an average investment of 88.7c had an interest cost of 4.4c per cwt. sold, the medium group with an investment of $1.402 had an interest cost of 7.7c, and the large investment group with an average investment of $2.263 had an interest cost of 11.3c.

TABLE 10—*Classification of producer-distributors' business data based on investment per 100 pounds of milk sold*

Item	Investment per 100 pounds of milk sold		
	Below $1.00	$1.00 to $1.74	$1.75 and over
1. Number of producer-distributors	20	31	24
2. Range in investment per cwt.	$.60-$.99	$1.00-$1.74	$1.75-$4.07
3. Average investment per cwt...	$.877	$1.402	$2.263
4. Average milk sold—pounds ..	134,272	130,752	102,427
5. Investment per distributor ...	$1178.23	$1833.35	$2318.21
6. Total costs—per cwt.	$1.700	$1.657	$2.007
7. Labor costs—per cwt.	$ .935	$ .799	$ .982
8. Depreciation costs—per cwt. ..	$ .121	$ .163	$ .197
9. Interest costs—per cwt.	$ .044	$ .077	$ .113
10. Hours labor—per cwt.	3.6	3.4	3.9
11. Cost of labor per hour (cents)	25.6	23.5	25.1

Depreciation cost increased in the same proportion as the investment, cost of depreciation being 12.1, 16.3, and 19.7c for the small, medium, and large-investment groups respectively.

Labor can be saved and costs decreased when the investment is put into equipment which replaces labor and makes it possible to distribute milk more efficiently. Since most of the increase in the total investment for the group having a high investment was in buildings, it did not reduce the cost of labor or increase the efficiency of selling milk. The value of buildings averaged approximately $300 higher per producer-distributor in the group having a high investment than in the group having a low investment. The group with a

low investment also had a smaller investment in trucks. Their investment in this means of transportation amounted to approximately $210, while the high-investment group averaged approximately $315 per producer-distributor. The increased value of the buildings and trucks would tend to increase items of cost such as interest, depreciation, taxes, and insurance without materially increasing the efficiency of distributing milk.

TABLE 11—*Classification of investment of 75 producer-distributors*

Type of investment	Average investment				
	Clarksburg	Fairmont	Morgantown	Wheeling	All groups
1. Buildings	$ 325.56	$ 400.42	$ 584.00	$ 619.30	$ 474.11
2. Equipment and supplies					
(a) Plant	405.06	93.75	195.07	372.50	259.50
(b) Delivery	400.44	261.83	242.43	388.45	324.41
3. Accounts receivable	1276.27	569.28	633.69	626.33	772.78
Total investment	2407.33	1325.28	1655.19	2006.58	1830.80
4. Percent investment in					
(a) Building	14	30	35	31	26
(b) Plant equipment	17	6	12	19	14
(c) Delivery equipment	16	20	15	19	18
(d) Accounts receivable	53	44	38	31	42

Classification of Investment

All the producer-distributors had three types of investment as follows: buildings, equipment, and accounts receivable. Equipment was classified into plant and delivery. The value of each type of investment and the percentage each classification was of the total are shown in Table 11. The investment in buildings was $474 11 for the average producer-distributor, or 26% of his entire investment for distributing milk. The Wheeling group of producer-distributors had the highest average investment in buildings, while the Clarksburg group had the lowest. The figure represents the 1934-35 average value of the building and not the original cost.

Equipment, including supplies used in bottling and in other plant operations, was valued at $259.50 for the average producer-distributor, which was equivalent to 14% of the total investment. The Clarksburg group had an investment of $405.06 for this item as compared with $93.75 for the Fairmont group.

Delivery equipment and supplies accounted for 18% of the total investment, or $324.41 per retailer. This equipment consisted of trucks, bottles, caps, crates, and other supplies used in delivering milk. The remaining 42% of the total investment consisted of accounts receivable past due. Some of these accounts were several months old but each retailer classed them as good accounts. The average value of such accounts was $772.78 for the average producer-distributor. The Clarksburg group with an investment of $1276.27

in this item and the Fairmont group with an investment of $569.28 in accounts receivable were the highest and lowest respectively. All accounts that were considered as not collectible were eliminated from this item and were charged off as a loss under bad debts.

The total investment per 100 pounds of milk sold was $1.48, as indicated in Table 12, and varied from a low of $1.26 in the Clarksburg group to a high of $1.78 for the Wheeling group of retailers.

TABLE 12—*Other factors affecting costs: Variations between markets and the average for the four markets in West Virginia*

Items	Clarksburg	Fairmont	Morgantown	Wheeling	Average all groups
1. Volume—milk sold..	191439	93696	102595	112924	122627
2. Labor cost per hour (cents)	26.3	22.3	27.5	23.1	24.7
3. Milk sold per hour labor (pounds)	29	25	30	27	28
4. Milk sold per mile (pounds)	16.6	12.1	14.5	9.7	12.9
5. Customers per mile	3.3	3.0	4.5	2.8	3.3
6. Truck costs per mile (cents)	5.1	5.5	5.5	4.5	5.2
7. Milk per unit sold (pounds)	1.75	1.65	1.90	1.95	1.81
8. Trips per bottle ...	28	68	63	64	48
9. Investment per 100 lbs. milk	$1.26	$1.42	$1.61	$1.78	$1.48
10. Percent of total labor hour used in delivering milk	76	76	77	82	78

Truck Efficiency

Truck costs per mile depend upon such factors as size of truck, size of load, and number of customers per mile. The group of producer-distributors with a large volume, as shown in Table 7, had a total truck cost per mile of 6.2c, while the producer-distributors with a small volume had a cost of 5.3c per mile, the difference in cost being caused by differences in size of load and size of truck. The larger trucks were necessary to carry the heavier loads. The heavier loads and larger trucks increase gas, oil, and tire costs per mile.

The group of distributors with a large volume however, were able to reduce their costs per cwt. of milk sold. This saving in truck costs was the result of the relatively large number of pounds sold for each mile traveled. The large-sized producer-distributors sold an average of 20 pounds of milk-equivalent for each mile traveled, while the small-volume group sold only 9 pounds. The difference in milk sold per mile does not mean that the customers of the producer-distributor with a small volume were scattered over a relatively larger territory, than those of others, but that more than half of the distance was traveled from the point of production to the first customer. The producer-distributors in this group lived from one to 10

miles from the city in which they sold their milk, and the small number of customers per mile was due to this fact rather than to their being scattered over a wide territory. It is evident, therefore, that the possibilities of some individual producer-distributors reducing their truck costs are few. First it would be impracticable to move closer to the city in which they distribute their milk, and secondly the volume of their business is fixed by the size of their farm or by the milk they are producing. Some saving, however, for the market as a whole may be possible because of the large number of producer-distributors traveling the same streets and same roads in reaching their consumers. For example, it was found in the Morgantown market that of the 14 distributors in the study, 10 sold on three of the same streets and 8 delivered milk on 10 of the same streets. In the Clarksburg market 17 producer-distributors sold on the same four streets and 12 sold on the same 10 streets. The same situation was found to exist in the Fairmont and Wheeling markets. This duplication of routes had a tendency to reduce the number of customers per mile and increase the length of the routes. It should be pointed out, however, that there were a large number of streets where one or two distributors supplied milk to all the families.

Bottle Losses

Bottle costs, including costs of cartons and other containers, represented 3.1 percent of the total cost of distributing milk. Considerable savings were made by some producer-distributors through reducing their bottle losses. For example, one distributor sold approximately 400 units for every bottle lost (the average for all being 48), which was equivalent to a cost of 0.6c per 100 pounds of milk sold. On the other hand, one producer-distributor sold only 12 units for every bottle lost, which amounted to a cost of 20c per 100 pounds of milk.

The average number of units sold in bottles for every bottle lost was 63 in Morgantown, 64 in Wheeling, and 68 in the Fairmont market. The average for the Clarksburg market was much lower than for the other three markets, being only 28. This was accounted for to some extent by the type of bottle association in operation during a part of the year.

The suggestion of reducing bottle cost for any market by increasing the trips per bottle may be questionable, as 68 trips per bottle is equivalent to using one bottle 136 days if used every other day and apparently represents an excellent use of each bottle. Individual producer-distributors may be able to reduce their loss to some extent by using registered trade-marked bottles, making an effort to have the consumer return his bottles, charging the consumer for bottles, or by having some efficient type of bottle exchange.

SOME COMPARISONS OF THE COSTS OF PRODUCER-DISTRIBUTORS AND DATA RELATED WITH DISTRIBUTING PLANTS IN THE SAME MARKETS

Cost records for nine distributing plants located in the Clarksburg, Fairmont, Morgantown, and Wheeling markets were studied and analyzed for the year 1933.* Although the data for the plants were for the calendar year 1933 and the cost data for the 75 producer-distributors were for a twelve-months period in 1934-35, some direct comparisons of the two methods of distributing milk may be valuable to the producers, distributors, and consumers. The nine milk distributing plants pasteurized and standardized their milk and in most cases performed other services for the consumer which did not enter into the cost of the producer-distributors. These factors, as well as others, should be considered in comparing the costs and other items as shown in Tables 13 and 14 and in the following discussion. The tables show a comparison of 22 distributing plants in West Virginia and of the nine plants located in the Clarksburg, Fairmont, Morgantown, and Wheeling markets, with the 75 producer-distributors whose operations were studied.

TABLE 13—*Comparisons of costs: 22 milk-distributing plants in West Virginia for 1933 compared with 75 producer-distributors for a twelve-month period in 1934-35*

Cost items per 100 lbs. of milk	75 Producer-distributors	9 Plants in Clarksburg, Fairmont, Morgantown, Wheeling	22 Plants*
1. Total costs	$1.763	$1.923	$2.050
2. Labor cost	.887	.792	.841
3. Depreciation	.160	.204	.220
4. Building and equipment cost	.215	.368	.397
5. Truck operating costs	.303	.150	.178
6. Loss of milk†	...	.046	.047
7. Bad accounts	.091	.079	.070
8. Interest costs	.074	.154	.177
9. Advertising	...	.021	.022
10. All other costs	.033	.109	.098

*Data from West Virginia Bulletin 266, "Milk Distribution Costs in West Virginia."

†Cost data for producer-distributors were based on fluid sales, whereas cost data for plants were based on milk entering plant.

The nine distributing plants located in the four markets of the 75 producer-distributors had an average cost of $1.92 per cwt. of milk as compared with the cost of $2.05 per 100 of the 22 plants. This is accounted for by the slightly smaller amount in most of the cost items shown in Table 13. The lower costs for the nine plants were due to the larger volume of business, which increased their efficiency in labor, equipment, and supplies.

*The data of these 9 distributing plants are summarized with 13 other plants in Bulletin No. 266, "Milk-Distribution Costs in West Virginia."

Volume

The average pounds of milk-equivalent sold by each of the nine distributing plants was 17 times greater than the average for each producer-distributor. The number of units, however, was in a slightly lower ratio because of the larger size of the units sold by the plants. The average-sized unit of the plants was 2.69 pounds of milk-equivalent as compared with 1.81 pounds for the producer-distributor. The main reason for the larger-sized units for the plants was the smaller proportion of fluid sales in the form of milk rather than to more milk being sold in quarts and gallons. The producer-distributors sold 86% of all their milk in the form of fluid milk, whereas the plants sold only 52% of their milk-equivalent as fluid milk.

TABLE 14—*Comparison of some factors affecting costs of 22 milk-distributing plants and 75 producer-distributors in West Virginia*

Item	75 Producer-distributors in 4 markets*	9 Plants in Clarksburg, Fairmont, Morgantown, Wheeling	22 Milk-distributing plants†
1. Average pounds milk-equivalent sold	122,627	2,066,606	1,606,526
2. Average number of units sold	67,557	768,283	701,540
3. Average pounds milk per unit	1.81	2.69	2.29
4. Percent of total sales were fluid milk	86.0	51.9	56.1
5. Percent of total sales were wholesale	27.2	64.5	69.6
6. Wage rate, cents per hour	24.7	37.8	36.5‡
7. Milk sold per hour of labor (lbs.)	28	48	42
8. Investment per 100 pounds milk sold	$1.48	$2.82	$3.14
9. Trips per bottle	48	27.8	23
10. Percent labor cost was of total cost	50	41	41
11. Cost of delivery—cents per quart	3.79	4.14	4.41
12. Value of accounts receivable per cwt. milk sold	.63	.65	.55

*For a twelve-month period in 1934-35.
†For the calendar year of 1933, see Bulletin 266.
‡Yearly rate converted to hour basis at 60 hours per week.

Another important difference in the type of fluid sales was the quantity sold at wholesale and retail, the nine plants selling approximately 65% of their milk at wholesale prices, while the producer-distributors sold only 27% of their milk at wholesale. This would indicate that the plants had the store, restaurant, and hotel trade, while the producer-distributors attempted to sell most of their milk directly to the consumer. The result of this variation in the type of sales would tend to return to the producer-distributor a relatively higher price for his milk than to the plants, especially since there was a spread of approximately 2c per quart of milk between wholesale and retail prices.

Costs per 100 Pounds of Milk-Equivalent Sold

The total costs of distributing milk was almost 16c per 100 pounds higher for the nine distributing plants than for the producer-distributors in the same markets. These higher costs for the distributing plants can be attributed to such things as pasteurization, labor costs per hour, additional service to the consumer, and higher administrative costs. The plants are located in the cities where they distribute their milk, and they usually attempt to give the consumer service at all times. This resulted in special deliveries and other services which increased administrative and delivery costs.

All the plants used accurate accounting systems which involved the keeping of one or more full-time employees. In addition one or more men supervised or managed the entire operations, whereas among the producer-distributors none had bookkeeping or supervision costs. In no case in this study were any costs charged for supervision by producer-distributors except as their labor was used directly in the distribution of the milk.

Analysis of the separate items of cost indicates that the labor cost for the producer-distributors was slightly higher than for the plants, being 88.7 and 79.2c respectively per 100 pounds of milk. The labor costs for the plants were equivalent to 41% of the total cost of distribution, while for the producer-distributors they amounted to 50% of the total costs.

Although the cost was practically the same for the same kind of labor by the two types of distributors, the efficiency in its use and the wage rate per employee varied widely. The producer-distributors sold only 28 pounds of milk per hour of labor and paid an average hourly rate of 24.7c. All distributing-plant labor was based on actual wages paid each month rather than hours worked. If each employee worked 60 hours per week in the distributing plants the average wage rate per hour would be approximately 37.8c, but the quantity of milk sold per hour worked would be 48 pounds.

It is interesting to note two factors concerning wages: first, that the operators of the producer-distributor group valued their labor at less than the average wage rate paid to all plant employees, including managers. The average rate of labor was 33.1c per hour for the operator labor of the producer-distributors. Secondly, if the producer-distributors paid their labor at the same rate paid by the plants, and they did not change their efficiency, the cost of labor would increase to $1.30 per 100 pounds of milk and the total costs would increase to $2.176 per cwt. An increase in the wage rate, however, might be accompanied by some increase in the efficiency of labor.

Depreciation and interest costs depend almost entirely on the investment per 100 pounds of milk. Since the plants had a much larger investment ($2.82) than the producer-distributors ($1.48) the plants had greater costs for these two items. These costs were 20.4c and 15.4c for depreciation and interest respectively for the plants as com-

pared with 16 and 7.4c for the producer-distributors. The distributing plants had such items as scales, vats, pasteurizers, bottling, and washing equipment which were not found in use by many of the producer-distributors. Buildings necessarily were larger and more valuable to house the additional equipment owned and used by the plants. Interest costs averaged more than 5% on the investment for the plants because of the large amount of money borrowed at a higher than 5% interest rate.

The increased use of equipment may be one of the important reasons why an employee of a plant was capable of handling more milk per hour of labor. Such operations as washing and bottling were done by hand or with low-cost equipment by the producer-distributors.

Truck operating costs were much higher for the producer-distributor (30.3c) than for the plants (15.0c). This was primarily because of the smaller loads and the longer routes of the producer-distributors. The smaller volume of business had a tendency to reduce the number of customers per mile and the location of the producer-distributors several miles out of the city would increase the truck cost for this group.

The producer-distributors had no cost for advertising, and no cost was included for milk losses. In the case of the plants, advertising costs were 2.1c per 100 pounds of milk produced, while the 4.7c cost caused by milk losses would be distributed among the other cost items if the plant costs were placed on the pounds-milk-sold basis.

Bad debts amounted to 9.1c for the producer-distributors and were slightly higher than the 7.9c for the nine plants. Several factors may account for this difference, the more important being that the plants may have a better system of collection, may stop the milk supply if the accounts are not paid in time, and may have a more preferred class of customers, such as stores and restaurants.

Building and equipment costs were higher for the distributing plants, where they amounted to 36.8c as compared with 21.5c for the producer-distributors. The large investment in buildings and equipment would increase such items of expenses as repairs, depreciation, taxes, and insurance. The cost of bottles was greater for the plants as the average bottle had to be replaced after making 28 trips, whereas in the case of the producer-distributor it made 48 trips before being lost. On the other hand, the cost of caps was slightly less for the plants because of the greater quantity of milk-equivalent sold per unit as compared with the producer-distributors.

The producer-distributors had an investment of 63c per 100 pounds of milk as compared with 65c for the nine plants located in the same market.

SUMMARY AND CONCLUSIONS

A study of the operations of 75 producer-distributors of milk in the Clarksburg, Fairmont, Morgantown, and Wheeling markets indicates that their average cost of distributing milk was $1.76 per 100 pounds of milk-equivalent sold. The range in the costs of individual producer-distributors was from $1.06 to $3.39.

Labor cost, which was approximately one-half of the total cost of distributing milk amounted to 88.7c. Three types of labor were used by the producer-distributors: operator, family, and "other labor." Operator's labor represented 37% of the total number of hours and 50% of the total labor cost for milk distribution, while family labor represented 23% of the total hours but only 18% of the labor costs. "Other labor" accounted for the remaining 40% of the hours and 32% of the cost. Operator's labor was valued at 33.1c per hour, family labor at 19.5c, and "other labor" at 19.6c. This is equivalent to an average of 24.6c per hour for all labor.

Labor efficiency was measured in terms of pounds of milk sold per hour of labor. The average labor efficiency was 28 pounds of milk-equivalent sold per hour of labor. When distributors were grouped on the basis of labor efficiency it was found that that group with high labor efficiency had an average distributing cost of $1.45 per cwt. as compared with a cost of $2.38 for the group using labor less efficiently.

The total truck cost of 41.1c was the second largest item of distributing cost, being 23.3% of the total cost. Truck cost amounted to 5.2c per mile traveled but varied from this figure in individual cases because of such factors as size of load, length of route, and number of customers per mile. Truck cost per mile increased with the size of load and number of customers per mile, but these same factors lowered the truck cost per cwt. of milk sold. Those producer-distributors having a sufficient volume to carry large loads traveled an average of 5 miles for each cwt. of milk sold with a truck cost of 6.2c per mile, but at a cost of only 33c per cwt. of milk sold. Those carrying a small load traveled 11 miles per cwt. of milk sold at a truck cost of 5.3c per mile but at a cost of 58c per cwt. of milk sold.

Repair and depreciation costs averaged 17.2c but varied for individuals according to total quantity sold and kind of equipment used. Included in this cost item is 9.8c for depreciation on trucks.

The cost of bottles, caps, and supplies amounted to 19.7c but in individual cases varied with the number of trips per bottle, care of equipment, and kind of supplies used.

Bad debts amounted to 9.1c; interest on investment, 7.4c; and taxes, insurance, coal, electricity, and other minor items, 3.9c.

In addition to labor efficiency and truck efficiency, volume of milk sold was another important factor affecting total distribution cost. Producer-distributors sold on the average 122,627 pounds of

milk-equivalent during the year. The distributing cost for 18 producer-distributors who averaged less than 70,000 pounds of sales per year was $2.33, while for 19 with average sales of more than 150,000 pounds the cost was $1.60 per cwt. of milk-equivalent sold.

Volume evidently affects costs through its effect on labor and truck efficiency, since producer-distributors with a small volume also were less efficient in their use of labor, truck, and other equipment.

Trips per bottle, investment per cwt. of milk sold, and losses because of bad accounts were factors having a minor effect on costs.

Fluid units averaged 86% of the total fluid sales, but only 72.8% of the fluid sales was sold at retail prices. Practically all the fluid milk was sold in quart and pint bottles, but cream was sold in half-pint bottles.

A comparison of the distribution cost of the 75 producer-distributors with the cost of nine milk-distributing plants in the same markets indicates that the former distributed milk at a lower cost than the latter. The average cost of distributing 100 pounds of milk by the nine distributing plants was $1.92 in 1933, while the average cost for the 75 producer-distributors was $1.76 in 1934-35. This difference in cost can be accounted for almost entirely by five factors of difference in operation:

(a) the average wage rate for the distributing plants was 37.8c per hour, while for the producer-distributor it was 24.6c;
(b) the distributing plants had a cost for pasteurization which was not incurred by producer-distributors.
(c) plants had a higher real estate and equipment investment per cwt. of milk sold than did the producer-distributors;
(d) plants, in purchasing all milk offered for sale by their producers, had to market a larger proportion in the form of surplus milk than was the case with the producer-distributors;
(e) plants make special deliveries and are equipped to render additional services to the consumer, not rendered by the producer-distributor. Extra charges for rendering additional services may not amount to the total cost of such services.

The producer-distributors, in addition to being able to distribute their milk at a lower cost, are also in a position to retain control of it until it reaches the consumer. Because of the comparatively small investment and large percentage of the labor which is family and operator's labor they can also adjust their costs to the price of milk more readily than can the plants.

The four milk markets included in this study had two or more distributing plants in each market and from 25 to 40 producer-distributors. This resulted in duplication of equipment and routes and led to considerable competition for business, with an unstabilizing effect upon market prices.

CONTENTS

	PAGE
Introduction	3
Purpose of study	3
Methods used in study	3
Definition of terms	4
Method of handling items of cost	5
Average volume of producer-distributors' business	6
Number of units sold	7
Total distribution cost per distributor	7
Amount of investment	8
Hours of labor used in milk distribution	8
Analysis of distribution costs	8
Total cost of distributing milk	9
Labor cost	9
Repairs and depreciation cost	10
Cost of bottles, caps, and supplies	11
Cost of taxes and insurance	12
Cost of operating trucks	12
Interest cost	12
Cost of bad debts	13
Other costs	13
Total distribution cost per quart	14
Classification of costs into plant, delivery, administrative, and interest costs	15
Classification of fluid sales	15
Factors affecting costs of distribution	17
Volume	17
Labor efficiency	19
Investment	22
Classification of investment	23
Truck efficiency	24
Bottle losses	25
Some comparisons of the costs of producer-distributors and data related with distributing plants in the same markets	26
Volume	27
Costs per 100 pounds of milk-equivalent sold	28
Summary and conclusions	30